



SEIZURES in the ED



Seizures

- Definition
 - clinical manifestation of abnormal excessive, & synchronous electrical discharge of cortical neurons
- Primary=epilepsy – 1% gen'l pop
 - condition of recurrent unprovoked seizures
 - usually presents as kids & adolescents
- Secondary
 - identifiable cause-more likely in adult presentation
- 8-10% risk sz/lifetime, 2-4% recurrent sz



Classification

- Generalized
 - convulsive
 - nonconvulsive
- Focal (partial)
 - simple- motor, sensory, autonomic
 - complex- impairment of consciousness
 - with secondary generalization



Generalized-convulsive

Comprises most secondary seizures

No aura

Abrupt, tonic stiffening, clonic jerking

Dysautonomia-apnea, loss of bladder/bowel control

Postictal phase

sleepiness, confusion, headache

duration, etc may vary(vs stereotypic sz)

Both hemispheres involved

- Bilat motor always assoc w/ +LOC



Generalized-nonconvulsive

- Absence
 - vacant stare, rapid on/off, usu kids
- Myoclonic
 - Few brief unilat or bilat muscle contractions
 - r/o metabolic encephalopathy ie liver/renal dysfunction
- Tonic
 - Sustained tonic contraction lg muscle groups
- Atonic
 - Loss of tone, “drop attack”



Focal-simple

- Motor-unilat, ?jacksonian march
- Somatosensory-paresthesias
- Special sensory-gustatory, olfact, visual, etc
- Autonomic-flushing, sweating
- Psychic-fear, deja vu



Focal-complex

- Impairment of consciousness (not LOC)
- =temporal lobe, psychomotor
- Frequently associated aura
 - Usu special sensory-smells, tastes, visual, strong emotion
- Automatism
 - Picking at clothes, lip smacking, repeated verbal



ED overview

- Status
- Febrile
- First & breakthrough seizures
- ETOH & drug related
- Pregnancy- co-existing & eclampsia
- Posttraumatic
- Pseudoseizure



Status epilepticus

- Seizure activity > 30 minutes or multiple seizures without interval normal mental status > 30 minutes
 - diagnosis at 5-10 min
- Generalized convulsive emergent and most common
- ~200,000/yr, recurs 1/3, ?10% kids initial



Prognosis

- Mortality 20% overall
 - 30% adults, 3-8% kids
 - Prognosis a factor of duration, age, cause, and comorbidities



Prognosis

Morbidity:

- resp-arrest, aspiration, pulm edema
- CNS-cerebral edema, hypoperfusion
- CVS- hypotension
- Metabolic- hyperthermia, -kalemia, acidosis, hypoglycemia, -phosphatemia, rhabdomyolysis
- ortho- fractures, dislocations



Status-Causes

- Metabolic/toxic
 - hyper- & hyponatremia, hyper- & hypoglycemia, hypomagnesemia, -calcemia, -phosphatemia, uremia, hepatic failure, acidosis, anoxia
- Structural- acute and longstanding
 - tumor, AVM, hemorrhage, infarction
- Infectious
 - meningitis, encephalitis, abscess, neurocysticercosis



Status- causes

- Drugs
 - Local anesthetics
 - Pen, imipenem, quinolones, INH, quinolones
 - Theophylline
 - TCA's, phenothiazines
 - flumazenil



Status-causes

- Drug withdrawal
 - ETOH
 - Benzo's
 - Baclofen
 - Barb's



Status- Causes

- Epilepsy
 - subtherapeutic AED levels
 - noncompliance, growth, drug interactions
 - specific triggers
 - acute febrile illness, sleep depriv, etc
- **Successful treatment of status may require identification and treatment of underlying cause



Status-evaluation

- Hx- genl/meds, seizures/AED, ppt's
- Exam- VS, airway, perf, neuro/sz obs
- Lab- CBG, UA/Utox, CBC, chemistries, HCG, BAL, AED levels
- Monitors- cardiac, dynamap, pulse ox
- CT head-all...MR if neg and etiol unclear
- ?LP-after CT, usu only if evid infection



Status-management

- ABC's
 - Airway/suction/O2/BVM-RSI/intub
 - IV- ?IO(all status meds OK)-x2
 - Protect
 - maintain homeostasis- euthermia, UO, BP
- Thiamine/ glucose (or rapid CS)
- AED's
- ?antibiotics



Benzo's

- 75-90% efficacy
- fast onset
- short-lived duration-exc ativan
- sedation, resp depression, hypotension



benzodiazepines

- Lorazepam=ativan
 - 0.05-0.1mg/kg IV to 10mg max
 - Slightly slower onset
 - longer antiepileptic efficacy-4-6 hrs
 - ?IM-less studied than versed
 - ?less resp depression
 - Best vs valium->dilantin, phenobarb , or dilantin alone (term w/in 20', still @60')



Benzo's

- Midazolam
 - 0.15-0.2mg/kg IV-max 10mg
 - IM
 - ?Buccal, ?intranasal-better vs rectal valium
 - refractory status role-less hemodynamic s/e's
 - Bolus then continuous infusion
 - 0.2mg/kg then 0.1-10mcg/kg/min



Benzo's

- Diazepam=valium
 - Fast, effective
 - 0.2-0.3mg/kg to 20mg max
 - Rectal double dose-IV formulation or diastat gel
 - Lipid soluble-rapid offset-15-20 min
 - Unpredictable IM
 - Prob increase resp depression
 - ?less efficacy than other benzo's



Status- AED's

- Phenytoin
 - 15-20mg/kg IVPB load @50mg/min max
 - NS only-precipitates w/ dextrose, LR
 - Not compatible with benzo's-2nd line
 - 80-90% efficacy
 - Local irritation at IV site
 - watch for bradycardia, AVB, hypotension
 - Related to rate of infusion
 - Slower if elderly, etc



Status-AED's

- Fosphenytoin
 - Prodrug hydrolysed in serum
 - Dosing same: "Phenytoin equivalents"
 - High cost
 - No precipitation issues
 - Decreased local irritation, ?IM
 - Still risk hypotension, brady's, blocks
 - Triple infusion rate still too slow as 1st agent



Status-AED's

- Phenobarbital

- 10-20mg/kg IV load @ 50-100mg/min max (1.5mg/kg/min peds)
- ?preferred if toxic/ metabolic etiology
 - Phenytoin may exacerbate sz in this setting
- hypotension > dilantin
- respiratory depression esp s/p benzo's
 - And more than benzo → phenytoin



Refractory status

- 6-9% prevalence, 50% mortality
 - ~anoxia/enceph vs low AED conc
- want EEG
 - t/c intensity decreases, neuromusc blocker
- ?medicine, neurology, anesthesia
- ICU bed, mech vent, pressors
- review potential etiologies-?specific therapy



Barbiturate coma

- Pentobarbital
 - 5-15mg/kg IV then 1-4mg/kg/hr IV
- ?Thiopental
 - 3-12mg/kg IV then 0.5-4mg/kg/hr
 - more hypotension



Propofol

- 1-2mg/kg then 2-10mg/kg/hr
- rapid
- Less hypotension vs barb coma
- ?less vs same efficacy in terminating status- diff mech



Refractory status

- phenytoin 5mg/kg → 5mg/kg
- phenobarb 5-10mg/kg
- propofol
- midazolam
- pentobarb



Refractory status

- ?rectal, IV valproate
- inhalational anesthetics- isoflurane
- ?MgSO₄
- ?Lidocaine
- Topamax via NG



Status-summary

- Airway, IV access, monitors, bloods
- Benzos-prob ativan, alternative if no IV
- Phenytoin load over 20-30 min
- Phenobarb if no success
 - Consider initially if drug/toxin
- Intub, pressors
- versed vs propofol vs barbs



Febrile seizures

- Primary childhood seizure, 2-4% prevalence
- Clinical characteristics
 - 6mo-6 yrs, often + family history
 - early in febrile course, $>38^{\circ}\text{C}$, usu $\times 1/24\text{hr}$
 - brief (8% $> 15\text{ min}$), generalized ($>85\%$)
 - normal mental status, neuro shortly thereafter
 - not associated with intracranial infection
 - no hx of nonfebrile seizure, neurodevelop nl



Febrile sz-evaluation

- As if no seizure
 - rely on fever, age and clinical findings
 - ?occult bacteremia- 4-12%- H flu/Prevnar
 - occult UTI- 4%
- Common causes
 - URI/OM primary
 - shigella, roseola disproportionately represented
- No routine lab, neuroimaging or EEG
 - ?basic if prolonged vomiting/diarrhea



Febrile sz- LP?

- Who to tap?
 - Young <12 mo yes, 12-18 mo ?, >18 mo no
 - Toxic
 - Clinically suggestive of meningitis
 - most will have lethargy, irritability, or vomiting
 - bulging fontanelle, neck stiffness, K or B 11-20%
 - Periph wbc and CSF pleocyt common from sz
 - Prior antibiotics
 - common!!, only 50% manifest any additional sx's



Febrile sz- prognosis

- Risk of recurrent febrile seizures
 - 30% overall, most within 2-3 yrs
 - 10% no risk factors, 80% if all risk factors
 - <1 yr at onset, +FHx, abnormal base neuro, or complex febrile sz (>15 min, >2 in 24 hr, focal)
- Risk of future nonfebrile sz (epilepsy)
 - 1-3% if simple (1% epilepsy prevalence genl)
 - 5-50% if complex, neuro/dev abn, +FHx



Febrile sz- Rx

- Abortive- why?
 - Antipyretics- not effective- AAP '99
 - No decrease in recurrence rate -?early onset sz
 - Valium
 - effective, risk reduction 40-50% at fever onset
 - rectal- 0.3-0.5mg/kg q 8hr while temp > 101'
 - ataxia, sedation, lethargy in up to 40%, ? resp depr
 - ? masking serious infection
 - ? far from care, parental anxiety, complex sz



Febrile sz- Rx

- Prophylactic- risk >> benefit, no harm to CNS from febrile sz ↓
 - Phenobarb
 - effective, risk higher cortical dysfunction (hyperactivity, learning problems)
 - Valproate
 - effective, risk fatal liver tox < 3 yrs, pancreatitis, thrombocytopenia, GI upset
 - Phenytoin & Carbamazepine-not effective



First seizure

- Hx/exam to confirm ictal event, determine underlying cause and identify sequelae
- lab- ACEP- Na, glucose, HCG
- neuroimaging- CT vs MRI, ? urgent if status, focal, abnormal MS/neuro, HIV, Ca, prolonged postictal, age >40, signif HA, trauma, anticoag, noncompliance...? all- (CT in ED, f/u MRI)
- EEG- all, urgent only in status
 - sens 50% x 1 , 90% x 3, no change w/ AED's



First seizure- DDx

- Ictus

- abrupt onset, any position, positive neuro sx's, stereotypic if multiple, purposeless activity, incontinence, tongue lac, postictal phase (lethargy, confusion, soreness)

- Syncope

- Emotional or other ppt, standing, prodromal symptoms & signs (nausea, hunger, "hot", pallor), quicker recovery/ no postictal, +Fhx, may have few tonic/ clonic motions



More DDx

- TIA –neg neuro,
- Migraine -longer aura, other sx prominent
- Movement disorders-hx spec event
- Pseudoseizures-easy ~ 1/sophistication
- ETOH blackouts
- Breathholding spells-stress,cyanosis,limp,clonic
- Narcolepsy/cataplexy
- hyperventilation



Disposition

- Inpatient vs outpatient
 - home if normal post
 - in if status, abn mental status, etc
- AED
 - controversial after one, most start after two
 - 40-50% recurrence w/in 3yrs, dec 50% w/ AED
 - 20-25% w/ S/E requiring D/C vs new AED
 - Tegretol, dilantin usu initial drug genl convuls



Disposition, continued

- Further work up
 - CT vs MRI
 - EEG
- DMV notification
 - CMR form
 - 3-6 mo seizure free to petition license
 - 3 mo if MD initiated dose reduction, 12 if recurrent
 - MD liable for recommendation



Disposition-education

- No driving, heights, swimming alone, baths, hang-gliding, boxing, etc
- work restriction for pilots & prof drivers
- no tongue blade/ basic airway for family
- mod caffeine, ? ETOH, no cocaine, meth
- adequate sleep



Disposition- education

- Contraception
 - failures on OCP's, DMPA preferred
- Pregnancy
 - 50% no change, 25% increase, 25% decrease
 - Monotherapy-whichever works, level q mo
 - folate 1-4mg/d, Vit K 10mg/d last trimester
 - cong anomaly double background rate ~5-6%
 - 3% risk of epilepsy in kids
 - breast feeding okay



Breakthrough seizures

- Evaluation

- exam- VS, stigmata of trauma, brief neuro
- lab- CBG, AED level...no empiric loading
- history- compliance, exacerbating factors

- Management

- remove exacerbating factors
- optimize AED level- ?PO vs IV, appropriate f/u
- CMR reporting



ETOH related sz

- Gen'l
 - usually early withdrawal, within 12-48 hr
 - seizure period is brief- usu < 6-12 hrs
 - usually 1-2 seizures max
 - status is rare



ETOH related sz

- Differential diagnosis
 - Structural- new/old trauma, subdurals
 - Metabolic- Na, glucose, Mg, etc.
 - Toxic- ?additional substance of abuse
 - Infection- meningitis
- Work up ?
 - 1st vs many?, consider standard labs, CT head?, EEG?



ETOH related- Rx

- Abstinence/ supportive care
- Benzo's –preferred agent
- MgSO₄
- AED's
 - controversial, ?compliance during binge, ?efficacy in ETOH vs underlying seizure focus



Drug-induced Sz

- Cocaine, amphetamines, PCP
- TCA's, bupropion, Li, phenothiazines
- Antihistamines
- ASA, theophylline
- INH, antibiotics
- Sedative/hypnotic withdrawal
- Toxic AED- tegretol, dilantin



Drug induced status

- Std therapy genl works
- Benzo → barbs preferred
- Specific therapies occasionally avail
 - Bicarb for ASA, TCA
 - Pyridoxine for INH
 - Dialysis for Li, ASA



Drug induced seizures

- TCA's
 - 4% incidence w/ OD- frequently terminal event
 - acidemia → ventricular dysrhythmias
 - maprotiline 19%, amoxapine 36%
 - Anticholinergic toxidrome, QRS widening
 - Rx-Bicarb, benzo's, barb's, charcoal
 - Avoid physostigmine



Drug induced Sz

- INH

- usually refractory to std measures
- $> 80 \text{ mg/kg}$ (5gm) acutely ingested
- Rx-pyridoxine mg/mg dosing or 5gm in 50NS kids- 80mg/kg
- benzos, barbs, charcoal



Drug induced sz

- Tegretol
 - Paradoxical sz in OD- 34% incidence
- Dilantin
 - described but less common
- benzo's, barbs
- **Check level before load



Drug induced sz's

- Lidocaine/ bupivacaine
 - lido tox $\sim 5\text{mg/kg} = 30\text{cc } 1\%$ in 70 kg pt
 - bupiv tox $\sim 2\text{-}3\text{mg/kg} = 40\text{cc } 0.5\%$ in 70 kg pt
 - Rx- benzo's, barbs, intralipid



Drug induced sz

- Cocaine

- 15% prevalence
- Usu benign self limited
- Worry if refractory/ persistent ALOC
- ?body stuffing/ packing- higher dose
- ?CNS bleed, CVA- consider CT, LP
- Benzo's (for all effects), Barbs



Drug induced sz

- Aspirin
 - ALOC, met acidosis w/ gap, mixed
 - Check level
 - Assoc w/ cerebral edema and hypoglycemia
 - Charcoal, bicarb, glucose
 - Benzos, barbs



more Drug induced sz

- Antibiotics

- pcn's- 0.13%, imipenem 1-3% latency up to 1 wk, quinolones- anecdotal, relative contra

- Flumazenil

- contra if TCA OD or benzo habituation
 - sole use is acute OD known limited to benzo's



Post traumatic sz

- Gen'l- 5-15% acquired sz disorders
- Classification
 - early < 1wk- ?<24hr immed=concussive
 - late > 1wk
- Evaluation- neuroimaging, in house obs
- Rx- dilantin or tegretol
 - treat only immediate and early and for 1 wk



Pseudoseizure

- Motor vs behavioral/mental status
- common
- Frequently a coexisting true seizure disorder
 - 10% sz pts w/ pseudoseizures, more w/ +Fhx
- Assume true seizure until proven otherwise
 - blinded neurologists correctly id'd in 37 of 52
 - Easy or impossible w/o adjunctive-video/EEG
 - Ease ~ 1/ sophistication



Pseudoseizure

- Suggestive features:
 - emotional ppt, gradual onset, out of phase movements, MS intact or better than expected-esp w/ bilat motor, no postictal, recall of ictal events, secondary gain, associated psych dx (borderline, affective disorder)
- Abortive maneuvers
 - prob avoid pseudocoma stuff
 - ?NS injection
- Testing- ABG, PRL, CPK, EEG



Pregnancy

- Eclampsia

- seizure/ coma in setting of preeclampsia
- Usually self-limited not status
- not proportional to severity of preeclampsia
- occurs antepartum, intrapartum and postpartum
- rare < 20 wks
- Rx- MgSO₄, expeditious delivery, ?benzo's, ?benzos ?dilantin- avoid polypharmacy